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SARP Research Topics

Master List of Research Topics of Interest to the OSMA Software Assurance Research Program (SARP)

This list is not all inclusive

1. Software Analysis
   - 1.1. Requirements
   - 1.2. Specifications
   - 1.3. Design
   - 1.4. Code
   - 1.5. Test
   - 1.6. Interface
   - 1.7. Architecture

2. Risk Assessment - Development of techniques for conducting and evaluating the correctness of probabilistic risk assessment (PRA) on software
   - 2.1. Use of artifact metrics to predict fault prone implementations
   - 2.2. Effectiveness of static versus dynamic metrics in predicting fault prone artifacts

3. Software Assurance practices for Auto-generated code
   - 3.1. Evaluation of available artifacts from Autocode Processes
   - 3.2. Verification of the Code Generator

4. Software Assurance practices for COTS integration
   - 4.1. V&V of Interfaces to COTS
   - 4.2. Validation of a COTS application for an intended purpose

5. Use of simulators/testbeds in support of V&V
   - 6.1. Generic simulators/testbeds
   - 6.2. Reconfigurable simulators/testbeds
   - 6.3. Certification of simulators/testbeds
   - 6.4. Sensitivity analysis to determine required accuracy of the test environment

7. V&V of intelligent systems
   - 7.1. Autonomous systems
   - 7.2. Adaptive systems

8. Software assurance practices for reused/heritage software
   - 8.1. Reuse/heritage factors which impact software risk
   - 8.2. Appropriate level of software assurance for reused/heritage code. (criteria examples: mission similarities, flight hardware similarities, flight software similarit ies, ground system similarities)

9. Reliability
   - 10.1. Reliability of OS
   - 10.2. Effects of changing operational profiles on software reliability (sensitivity)

11. Case Studies (What works and what doesn't)
   - 11.1. Characteristics of successful and unsuccessful software development projects
   - 11.2. Software development project risks resulting from incorrect cost estimating
   - 11.3. Software development project risk as a function of various management practices
   - 11.4. Reuse/product families
   - 11.5. Most costly software errors
   - 11.6. Effective methodologies (agile, OO, etc.)

12. Tandem experiments to improve software assurance (Excursions from current development, test, or V&V practices to determine the effectiveness of new practices.)

13. Transfer of best practices (Adaptation of best software development and testing practices to support some aspect of software assurance.)

14. IV&V
   - 14.1 Effectiveness of existing IV&V effort estimating tools (e.g. Risk Cube, CARA)
     - 14.1.1. Effectiveness of identification of error prone artifacts
     - 14.1.2. Effectiveness of analysis activities as applied to an artifact
     - 14.1.3. Effective tailoring of IV&V effort to desired risk reduction levels
   - 14.2. Practical model checking in support of IV&V
     - 14.2.1. Identification of appropriate techniques for IV&V model checking
     - 14.2.2. Identification of appropriate artifacts for IV&V model checking
     - 14.2.3. Identification of appropriate NASA projects for IV&V model checking
   - 14.3. IV&V of Software Development Processes
   - 14.4. Appropriateness of IV&V for reused/heritage software (criteria examples: mission similarities, flight hardware similarities, flight software similarities, ground system similarities.
   - 14.5. Return on investments

15. Benefits of software standards on the development of NASA software (e.g. FAA certification standards; e.g. RTCA DO-178B)

16. Assurance of field programmable gate arrays and Application-Specific Integrated Circuits (ASICs)